

Development of Technology Shortlist for future investigations

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Content

- Recall previous and current activities on technology evaluations
- Detail EUROCONTROL/European activities
- Present some initial results
- Next steps

What was done

- Evaluation Criteria – Initial Work
- FCS EUROCONTROL/FAA Initial Assessments
 - QinetiQ, and
 - ITT
- Other Recent Assessments
 - EC Roadmap Study
 - NASA MCNA Study

What is happening now

➤ FAA/ITT

- Further elaboration of Evaluation Criteria
- Update of ITT Technology Assessment Report

➤ EUROCONTROL

- Discussions in Air Ground Communications Focus Group
 - Initial Evaluation Criteria: difficult to agree on metrics, iterative process => can be long
 - Alternative approach: Use expert judgement on available information and build upon

Goal: List of Promising Technologies for in-depth investigations

Development of Technology Shortlist: Alternative Approach – Key Features

Two step approach:

- Step 1
 - Focus on capacity and QoS requirements from COCR
 - Use results from previous assessments
 - Take into account new developments
 - Establish initial list of promising technologies
- Step 2
 - Complete investigations
 - Make recommendations for FCI

Future Communications Infrastructure - Key Drivers:

- support the future ATM communications requirements, as required in all phases of flight;
- employ technology in a way that is transparent to the user;
- avoid single point of failures affecting simultaneously the various types of communication;
- enable smooth transition and provide support for legacy systems (backward compatible);
- be implementable (time and space) in a phased manner but be globally applicable;
- include provision(s) for growth in capabilities;
- maximise synergies (telecomm, military) and maximise reuse of available technology;
- ...

Future Communications Infrastructure – Key Drivers (cont.)

...

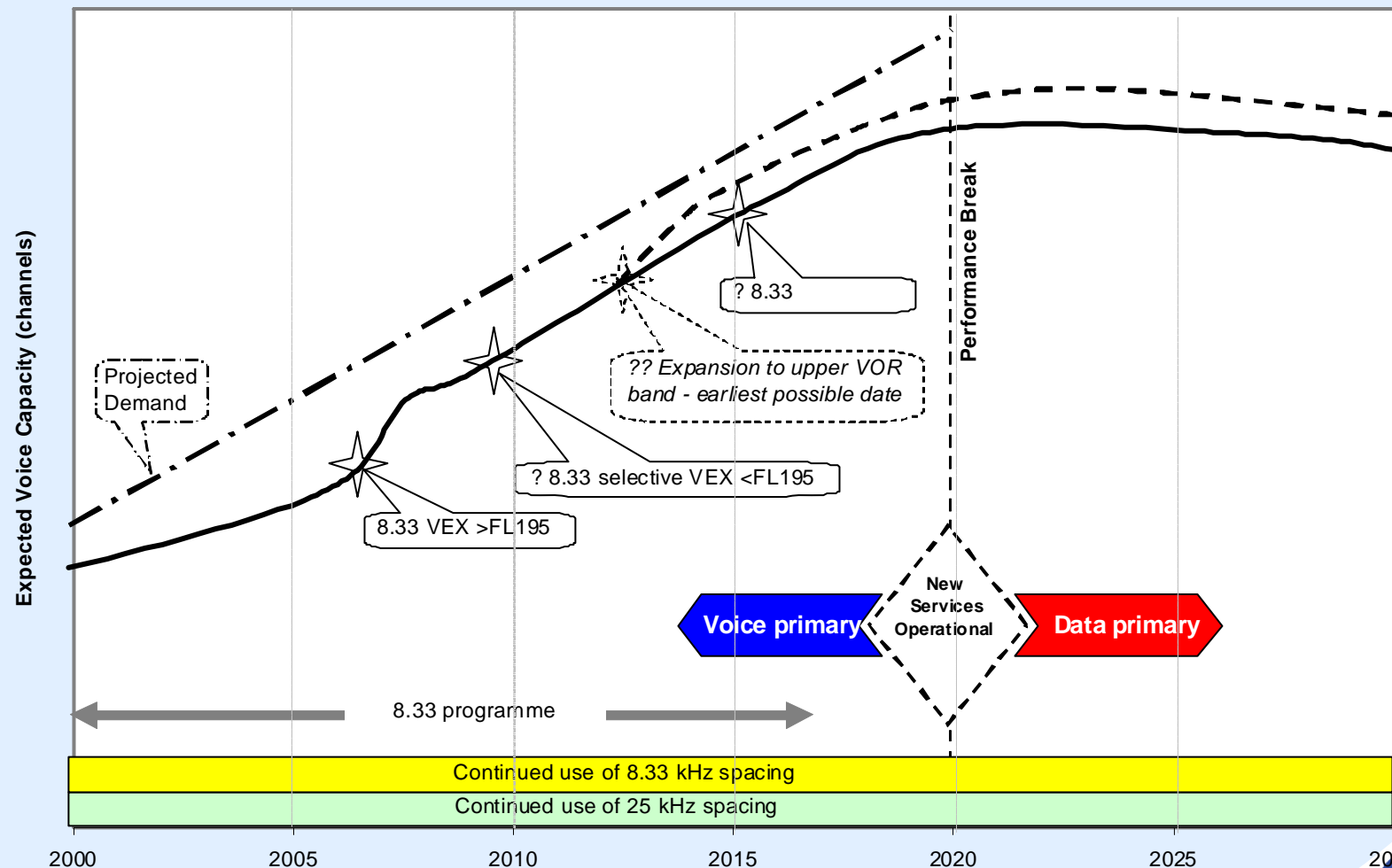
- be spectrally efficient and be cost-beneficial
- make efficient use of existing and already planned infrastructure;
- if required, use different technologies for different phases of flight and/or applications;

FCI will be a system of systems comprising new technologies and including the legacy ones

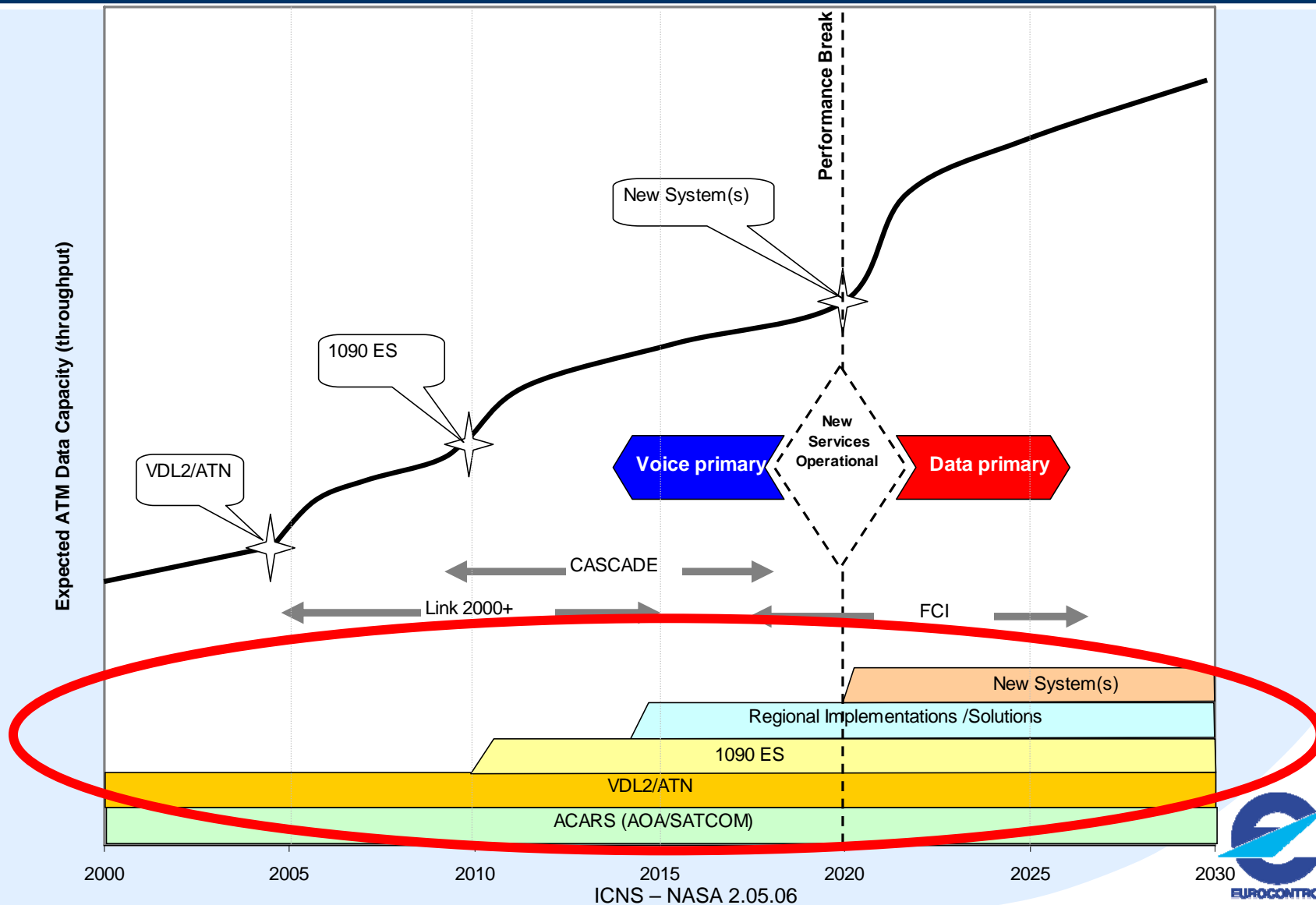
**Technology Assessment provides initial input to
Architecture Considerations => Software Radio?**



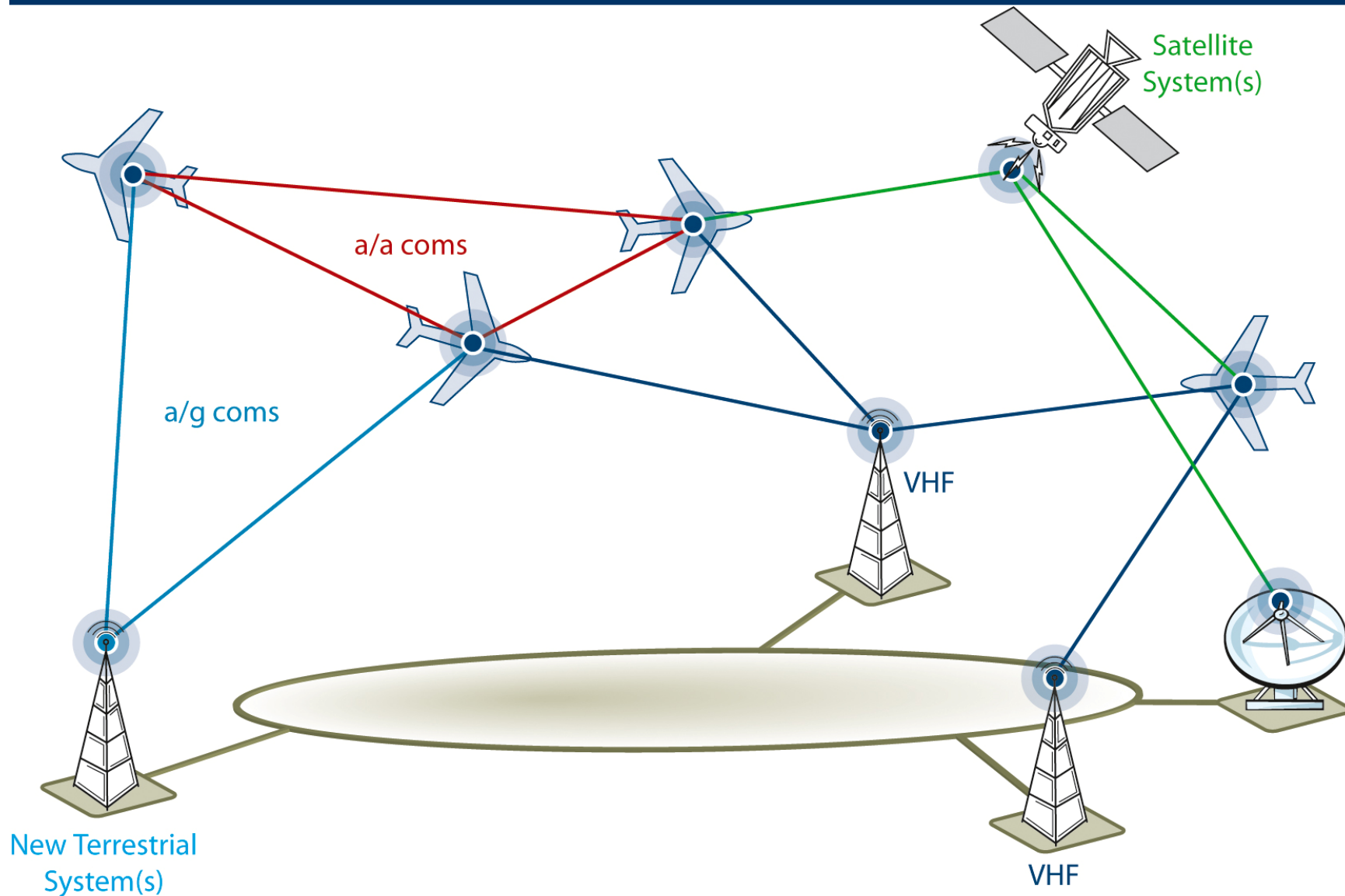
Voice Demand - Technology Evolution



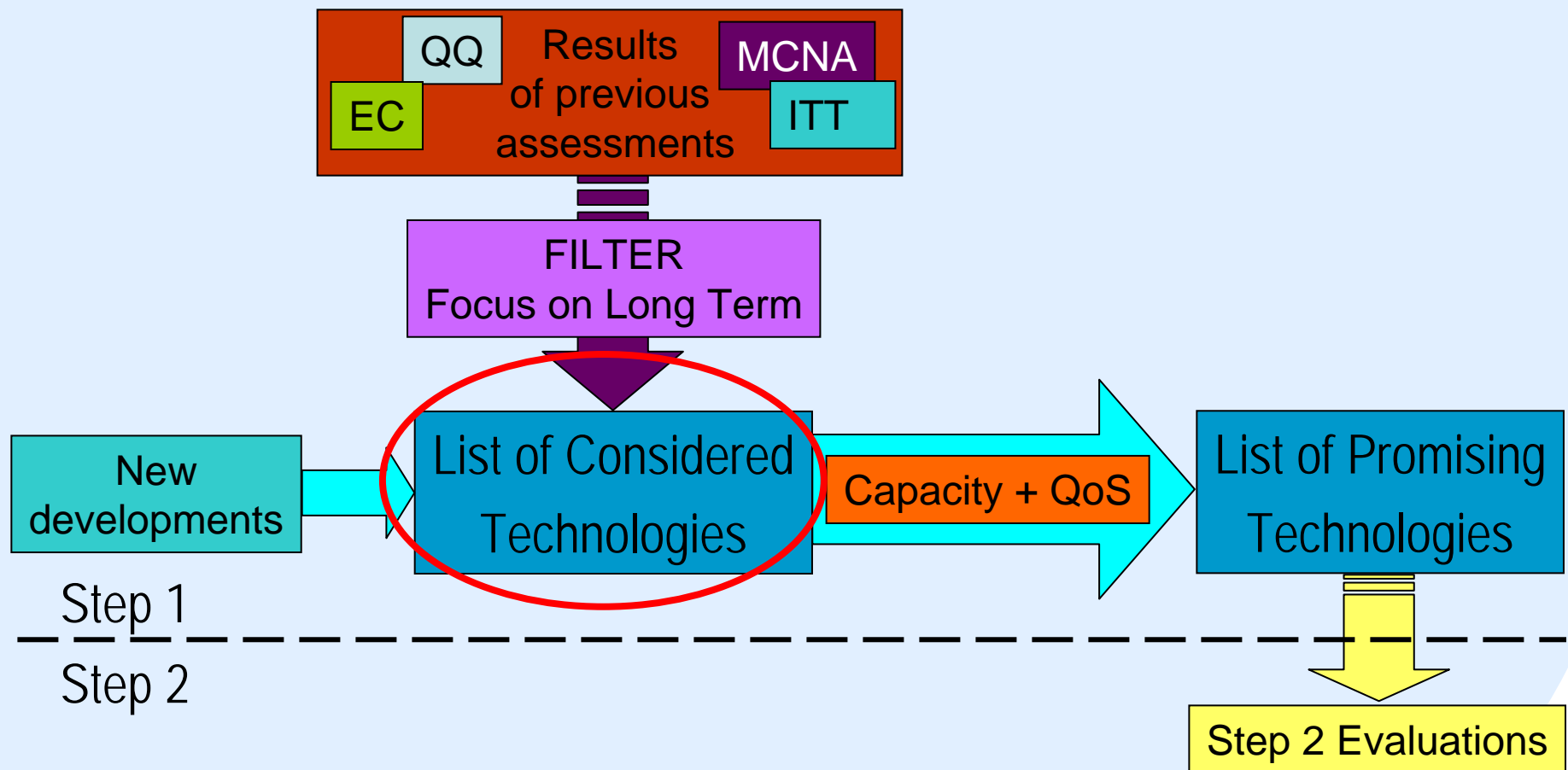
Data Demand – Technology Evolution



A potential scenario for 2020+



Step 1: Methodology



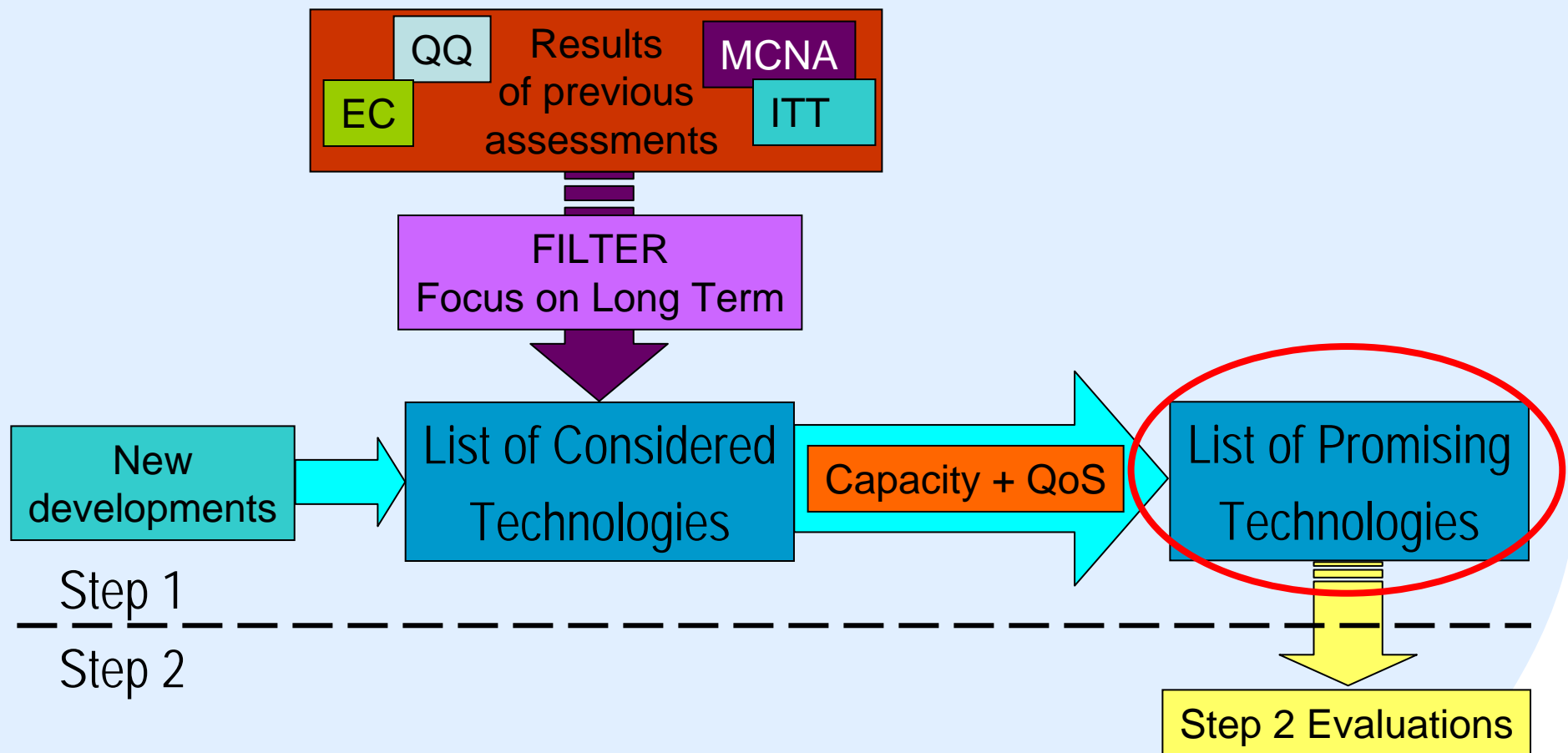
Step 1: List of Considered Technologies

Evolution of existing aeronautical systems or concepts	<ul style="list-style-type: none">• (x)DL3• ETDMA• (x)DL4
Terrestrial systems	<ul style="list-style-type: none">• B-VHF• 3G systems (WCDMA)• P34
Satellite systems	<ul style="list-style-type: none">• INMARSAT SwiftBroadband• Iridium• New satellite System(s)
Airport/surface systems	<ul style="list-style-type: none">• 802 derivatives .11x, .16 and .20• Airport Data Link

Step 1: Evaluation Criteria

- ✓ Data only (no voice): ATS+AOC, 2 timelines: Phase 1 and Phase 2
- ✓ Functions: A/G and A/A, Addressed and Broadcast
- ✓ Airspaces: Airport/Surface, TMA, Enroute and Oceanic
- ✓ Capacity:
throughput (in bps)
- ✓ QoS:
Integrity
Availability
(Continuity, Latency)

Step 1: Methodology



Step 1: Short List of Technologies

Evolution of existing aeronautical systems or concepts	<ul style="list-style-type: none">• <u>(x)DL3</u>• <u>ETDMA</u>• <u>(x)DL4</u>
Terrestrial systems	<ul style="list-style-type: none">• B-VHF• 3G systems (WCDMA)• P34
Satellite systems	<ul style="list-style-type: none">• INMARSAT SwiftBroadband• <u>New satellite System(s)</u>
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Technology Supported Functions

Technology	Function/Service			
	Air/Ground Addressed Data	Air/Air Addressed Data	Air/Ground Broadcast Data	Air/Air Broadcast Data
(x)DL3	✓	✓	✓	✓
ETDMA	✓	✓		
(x)DL4	✓	✓	✓	✓
B-VHF	✓	✓		
WCDMA (3G)	✓	✓	✓	
P34	✓	✓	✓	✓
Swiftbroadband	✓		✓	
New satellite system(s)	✓	✓	?	?
802.11x	✓	✓	✓	
802.16/20	✓		✓	
ADL	✓		✓	

Spectrum Considerations - Draft

BAND	AIRSPACE	CURRENT TECHNOLOGY	POTENTIAL FUTURE TECHNOLOGY
HF band	Oceanic, Remote	HF Voice, HF Datalink	
VHF band	Airport, TMA, Enroute	8.33/25KHz DSB-AM, VDL2, <i>VDL4</i>	B-VHF
upper VOR band	Airport, TMA, Enroute		B-VHF, xDL4
L Band (Lower part)	Airport, TMA, Enroute	1090 ES <i>UAT</i>	xDL3, xDL4, ETDMA, B-VHF, WCDMA, P34,
C Band	Airport surface		802.xx, B-VHF, WCDMA, ADL
L Band – Sat	TMA, Enroute, Oceanic	AMSS SATCOM, Iridium	Swiftbroadband, New Satellite System(s)



Step 2 Considerations: Initial List

- ✓ *Definition of evaluation scenarios (common to technologies)*
- ✓ *Technology–specific deployment scenarios (including transition)*
- ✓ *aircraft integration (antennas, retrofit issues, etc)*
- ✓ *Compatibility studies and spectrum efficiency*
- ✓ *cost for ground and avionics infrastructure*
- ✓ *certification aspects*
- ✓ *transition aspects*
- ✓ *technology maturity*
- ✓ *standardization status*

Next Steps

- ✓ Complete Step 1 evaluations
- ✓ Definition of shared work plan for Step 2
- ✓ Coordinate input for SESAR
- ✓ Complete Step 2 evaluations => Recommendations
- ✓ Perform in-depth technology investigation
- ✓ Progress in parallel other activities
 - ✓ Flexible Airborne Architecture
 - ✓ Refinement of Operational Requirements
 - ✓ Follow technology developments